2022 International Conference on Applied Mathematics, Informatics, and Computing Sciences (AMICS 2022)

December 5-7, 2022

Online via Microsoft Teams

Conference Program

Organizer

Bosen Academic Research Institute

AMICS 2022
CONFERENCE PROGRAM

December 5th-7th, 2022

China Standard Time (UTC/GMT+8:00)

ONLINE-Microsoft Teams Meeting

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Tuesday, December 6th, 2022	
MS Teams Link: http://www.academicconf.com/teamslink?confname=AMICS2022	
Chair: Prof. M Shamim Kaiser, Institute of Information Technology, Jahangirnagar University, Bangladesh	
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MS Teams Link: http://www.academicconf.com/teamslink?confname=AMICS2022	
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Part II Plenary Session

Plenary Speech 1: On a Method of Classification of Integrable Lattices in 3D via Characteristic Lie-Rinehart Algebras

Prof. Habibullin Ismagil

Head of Department of Mathematical Physics, Institute of Mathematics with Computing Centre - Subdivision of the Ufa Federal Research Centre of the Russian Academy of Sciences, Russia

Biography:

Education

1972-1977 Bashkir State University, Department of Mathematics. Diploma, speciality “Mathematics and teaching of Mathematics”. Master’s degree.

1977-1980 Bashkir State University (post-graduate course) Supervisor Prof. Alexey Shabat.

1982 Ph.D. in Differential Equations and Mathematical Physics.

1996 The second Doctor dissertation.

Research Interests

Methods for solving nonlinear differential and discrete equations of mathe-matical physics. Symmetries and their applications in integrability theory. Integrability criteria for non-linear partial differential equations and their discrete analogs, classification algorithms for integrable models.

Research Experience

To this moment I have more than 100 articles published in Russian and foreign world-famed scientific journals. In my articles the following problems are studied:

The stable recurrent algorithm for solvng the Riemann-Hilbert problem of analytical conjugation of functions is suggested. Based on this algorithm a numerical realization of the direct and inverse scattering transform method for NLS type equations is developed (in collaboration with A.G. Shagalov).

The phenomenon of boundary condition for soliton equations preserving the integrability property by using symmetries is investigated in collaboration with M. Gurses, V.E. Adler, S.I. Svinolupov and others.

The notion of the characteristic operators introduced for the case of PDE by A.B. Shabat is adopted to the discrete models and applied to the problem of the classification of semidiscrete models integrable in sense of Darboux (in collaboration with N. Zheltukhina, A. Pekcan).

The notion of generalized invariant manifold for nonlinear PDE and their discrete analogs was introduced. It was observed that such manifolds provide a very effective tool for constructing Lax pairs and recursion operators, as well as for searching particular solutions to nonlinear integrable models (in collaboration with M.N. Kuznetsova and A.R. Khakimova).

The effective method for integrable classification of nonlinear lattices with three independent variables is worked out based on the using hierarchies of the integrable in sense of Darboux finite field reductions (in collaboration with M.N. Kuznetsova, A.R. Khakimova and A.U. Sakieva).

List of publications can be found in http://www.mathnet.ru/eng/person17529.

Abstract: The report discusses a new method for classifying integrable nonlinear differential-difference equations with three independent variables. Integrable equations have a wide range of applications in mathematical physics, so the problem of describing integrable equations is in demand. In our recent papers, we have developed an efficient approach to the problem of classifying integrable nonlinear equations with three independent variables, at least one of which is discrete. The idea of the method is based on the observation that by appropriately terminating a given integrable equation, one can reduce it to a system of hyperbolic type equations in two independent variables, which is Darboux integrable. A system of equations with two independent variables of hyperbolic type is called Darboux integrable if it admits a complete set of independent integrals in each of the characteristic directions. In turn, systems that allow a complete set of integrals have finite-dimensional characteristic Lie-Rinehart algebras. We use this fact as a classification criterion.

Plenary Speech 2: Advances of Optimal Control in Immunotherapeutic Treatment of Non-communicable Disease

Prof. Dr. Md. Haider Ali Biswas

Mathematics Discipline, Science Engineering and Technology School, Khulna University, Bangladesh

Biography: Dr. Md. Haider Ali Biswas is currently affiliated with Khulna University, Bangladesh as a Professor of Mathematics under Science Engineering and Technology School and he served as the **Head of Mathematics** Discipline from 2015 to 2018. Prof. Biswas obtained his B Sc (Honors) in Mathematics and M Sc in Applied Mathematics in the year 1993 and 1994 respectively from the University of Chittagong, Bangladesh, M Phil in Mathematics in the year 2008 from the University of Rajshahi, Bangladesh and PhD in Electrical and Computer Engineering from the University of Porto, Portugal in 2013. He has more than 22 years teaching and research experience in the graduate and post-graduate levels at different public universities in Bangladesh. He published **Three Books**, **Seven Book Chapters** and more than 200 research papers in the peer reviewed journals and international conferences. Prof. Biswas supervised (is supervising) more than 80 undergraduate students (Undergraduate Project Thesis), 40 MSc Students (MSc Thesis and Project Thesis), 3 MPhil Students and 7 PhD Students at Different Public Universities in Bangladesh and Indonesia. Prof. Biswas has worked at several R & D projects in home and abroad as PI and/or Researcher, particularly he conducted several research projects funded by Khulna University Research Cell, the Ministry of Science and Technology, Bangladesh, University Grants Commission of Bangladesh and The World Academy of Science (TWAS), Trieste, Italy. His present research interests include Optimal Control with Constraints, Nonsmooth Analysis, ODEs and Dynamical Systems, Mathematical Modeling, Mathematical Ecology, Environmental modeling and Climate change, Mathematical Biology and Biomedicine, Epidemiology of Infectious Diseases. Since the last ten years, Prof. Biswas has been working on the applications of mathematical models for designing and implementing those to real life problems, specially for the sustainable/optimal management under the changing environment due to global warming. He is the life/general members of several professional societies and/or research organizations like Bangladesh Mathematical Society (BMS), Asiatic Society of Bangladesh (ASB), Institute of Mathematics and its Applications (IMA), UK, European Mathematical Society (EMS) and Society for Mathematical Biology (SMB). Dr. Biswas is the founder member of Mathematical Forum Khulna and served as the General Secretary of the Forum in 2013-2015. Dr. Biswas organized several national and international seminars/workshops/conferences in home and abroad and he has been working as Editor/Member of editorial boards of several international peer-reviewed journals. Professor Biswas delivered more than 50 Talks as **Keynote/Invited/Plenary/Panel Speaker** at several international conferences/seminars/workshops in home and abroad. Professor Biswas was nominated as the Member of the Council of Asian Science Editors (CASE) for 2017-2020 and the Associate Member of the Organization for Women in Science for the Developing World (OWSD) since 2017. Recently, Professor Biswas has been elected as a **Vice-President** of Bangladesh Mathematical Society (BMS) for the year 2022-2023, and also appointed as the **Associate Editor** of the international journal

GANIT- Journal of Bangladesh Mathematical Society (BMS) for the year 2022-2023. Dr. Biswas has been nominated as a Member of Executive Committee of the IEOM Society, Bangladesh Chapter and also serving as the **Treasurer** of the IEOM Society, Bangladesh Chapter. He is also serving as the Faculty Advisor of the IEOM Society Khulna University Chapter. Professor Biswas is presently serving as the Founding President of Bangladesh Society for Mathematical Biology (BSMB) for the year 2022-2023.

Abstract:
Cancer is the most killer disease among all non-communicable diseases and pose a great threat in global public health. It is the result of unconstrained growth of immature white blood cells in the blood. Till to date, immunotherapy is the most effective strategy for cancer treatment. It is one of the varieties of chemotherapy which not only kill/halt the pathogen in the body, but also help increasing the long-term internal resistance of our immune systems so that the body itself can fight against the virus. In this talk, we developed a simple deterministic model of coupled nonlinear ordinary differential equations to describe the cell-cell interactions of such leukemia cancer. The model was further modified by introducing two control variables; u_1 and u_2 which represent immune boosting drugs and engineered T-cell therapy respectively as immunotherapeutic treatment strategies to minimize the number of infected cells in the blood. Initially, the model was validated for the well posedness of the solution by investigating the stability of the equilibria based on the basic reproduction number. Pontryagin's minimum principle was applied as effective optimal control strategies in order to minimize the number of infected cells as well as the costs of the controls, Finally, numerical simulation of the proposed model and optimal control model were performed to show the effectiveness of immune boosting drugs as well as immunotherapy to defend leukemia in the blood.

Invited Speech 1: AIC1012 Fractional distributional representation of gamma function

Asifa Tassaddiq*
Department of Basic Sciences and Humanities, College of Computer and Information Sciences Majmaah University, Al Majmaah 11952, Saudi Arabia
**Corresponding author: a.tassaddiq@mu.edu.sa*

Abstract. Inspired by the new investigations about fractional derivatives of Dirac delta function, the author uses a fractional Taylor series to obtain a distributional representation of gamma function in terms of its fractional derivatives. The convergence of this new representation is discussed in the sense of distributions. Laplace transform of new representation is obtained which led to several new results. A new fractional kinetic equation is formulated and solved. Classical as well as the distributional solution of the formulated problem is obtained.
Keywords: fractional derivatives of delta function; Taylor series; H-function; kinetic equation

Invited Speech 2: AIC1076 Iterated function system of generalized hutchinson operators for global fractals

Talat Nazir*
Department of Mathematical Sciences, University of South Africa, Florida 0003, South Africa
**Corresponding author: talatn@unisa.ac.za*

Abstract. Iterated function systems are based on the mathematical foundations laid by Hutchinson [1]. He showed that Hutchinson operator constructed with the help of a finite system of contraction mappings defined on a Euclidean space R^n has closed and bounded subset of R^n as its fixed point, called attractor of iterated function system (see also in [2]). In this context, fixed point theory plays significant and vital role to help in the construction of fractals. The aim of this talk is to present the sufficient conditions for the existence of attractor of a generalized iterated function system composed of a complete metric space and a finite family of generalized contractive mappings. Some examples are presented for construction of global fractals to support our main results presented therein. The results obtained in the presentation extend and generalize various well known results in the existing literature [3, 4].

References

[1] J. Hutchinson, Fractals and self-similarity, Indiana Univ. J. Math., 1981, 30 (5), 713-747.
[2] M. F. Barnsley, Fractals Everywhere, 2nd ed., Academic Press, San Diego, CA (1993).
[3] T. Nazir, M. Khumalo, V. Makhoshi, Iterated function system of generalized contractions in partial metric spaces, FILOMAT, 35:15 (2021), 201-220.
[4] M. Khumalo, T. Nazir and V. Makhoshi, Generalized iterated function system for common attractors in partial metric spaces, AIMS Mathematics, 7 (7) (2022), 13074-13103.

Invited Speech 3: AIC1087 A special construction of Lagrangian submanifolds in a flat complex space

Miroslava Antić*
Faculty of Mathematics, University of Belgrade, Serbia
**Corresponding author: mira@matf.bg.ac.rs*

Abstract. Lagrangian submanifolds play an important role in classical mechanics and mathematical physics in particular in supersymmetric field theories and in string theory. Hence their structure and particular types of examples are subject of great interest.
The procedure of constructing a Lagrangian immersion in the complex projective space, starting with two other Lagrangian immersions into complex projective spaces of lesser dimension is known as a Calabi product, motivated by the similar construction in the affine differential geometry. In particular, one may consider a point instead of the one of the immersions, and in both cases the submanifold has a warped product structure of the interval and one or two Lagrangian immersions. Such Lagrangian submanifold then admits a splitting of the tangent bundle into orthogonal subbundles defined in terms of the corresponding second fundamental form, in case of a point and an immersion decomposition consists of two components and in case of a proper Calabi product, decomposition has three components. The generalization of this notion was investigated for Lagrangian immersions in non-flat complex space forms. Here we study the flat case and investigate the properties of the Lagrangian immersions with tangent bundle admitting the decomposition in question and we give explicit expressions for such immersions.
Keywords: lagrangian submanifolds, warped product, complex space

Part III E-Poster Presentations

Online Poster Guidelines

- All E-Posters will be demonstrated on the official conference website.
- Participants could view and share their comments on the website. If you have any questions on E-posters, kindly contact conference secretary for assistance.
- Signed and stamped electronic presentation certificate would be issued via e-mail after the presentation is delivered.

List of Posters

E-posters could be accessed via http://www.academicconf.com/teamslink?confname=AMICS2022

AIC1037	Approximate controllability of fractional stochastic sobolev-type volterra-fredholm integro-differential equation *Dr. Udhayakumar R, Vellore Institute of Technology, India*
AIC1042	Selection of most effective COVID-19 virus protector using a novel MCGDM technique under linguistic generalised spherical fuzzy environment *Dr. Avishek Chakraborty, Academy of Technology, India*
AIC1043	On weaving generalized frames and generalized riesz bases *Dr. Deepshikha, University of Calcutta, India*

Abstracts of Poster Session

AIC1037 Approximate controllability of fractional stochastic Sobolev-type Volterra-Fredholm integro-differential equation

R. Udhayakumar
Department of Mathematics, School of Advanced Sciences, Vellore Institute of Technology, India
Corresponding author: udhayaram.v@gmail.com

Abstract. An approximate controllability of fractional stochastic Sobolev-type Volterra-Fredholm integro-differential equations of order $1<r<2$ is the major impetus for our discussion. The essential discoveries are established using principles and ideas from stochastic analysis, the theory of cosine family, fractional calculus, and Banach fixed point techniques. We begin by emphasising the availability of mild solutions before demonstrating the fractional stochastic control equation's approximate controllability. Our findings are then applied to the notion of nonlocal circumstances. Finally, an application for drawing the theory of the key results is established.
Keywords: approximate controllability, stochastic system, volterra-fredholm integro-differential equation, fractional derivative, sobolev type equation, nonlocal conditions

AIC1042 Selection of most effective COVID-19 virus protector using a novel MCGDM technique under linguistic generalised spherical fuzzy environment

Tipu Sultan Haque[1], Shariful Alam[2], Avishek Chakraborty [3]*
[1,2] *Department of Mathematics, Indian Institute of Engineering Science and Technology, Shibpur, Howrah 711103, India*
[3]*Department of Engineering Science, Academy of Technology, Adisaptagram, Hooghly 712502, India*
**Corresponding author: tirtha.avishek93@gmail.com*

Abstract. In this article, we have introduced a new linguistic generalized spherical fuzzy set by combining the idea of generalized spherical fuzzy set and linguistic fuzzy set. Linguistic generalized spherical fuzzy set is described by linguistic positive, linguistic neutral and linguistic negative membership degrees with the condition that the square sum of its linguistic membership degrees is less than or equal to 3 which deal with the uncertain and imprecise information in decision making in a much more suitable way. We have discussed some basic operations of linguistic generalized spherical fuzzy sets and introduced new score and accuracy functions to compare any two linguistic generalized spherical fuzzy numbers. We have developed various types of aggregation operators based on the newly defined linguistic generalized spherical fuzzy set, which have been manifested to construct a new multi-criteria group decision-making technique. Numerical example has been presented to demonstrate the proposed model. Finally, sensitivity and comparative analysis is performed to show the reliability and efficiency of the new multi-criteria group decision-making technique.
Keywords: linguistic generalized spherical fuzzy number (LGSFN), power aggregation (PA) operators, multi-criteria group decision-making (MCGDM), COVID-19 virus protector

AIC1043 On weaving generalized frames and generalized riesz bases

Deepshikha[1*], Aniruddha Samanta[2]
[1] *Department of Mathematics, Shyampur Siddheswari Mahavidyalaya, University of Calcutta, India*
[2] *Department of Mathematics, Indian Institute of Technology Kharagpur, Kharagpur, India*
**Corresponding author: E-mail- dpmmehra@gmail.com*

Abstract. Weaving frames have potential applications in wireless sensor networks that require distributed processing of signals under different frames. In this paper, we study some new properties of weaving generalized frames (or g-frames) and weaving generalized orthonormal bases (or g-orthonormal bases). It is shown that a g-frame and its dual g-frame are woven. The inter-relation of optimal g-frame bounds and optimal universal g-frame bounds is studied. Further, we present a characterization ofweaving g-frames. Illustrations are given to show the difference in properties of weaving generalized Riesz bases and weaving Riesz bases.
Keywords: hilbert frames, frame operator, generalized frames, riesz bases, weaving frames

Part IV Oral Presentations

Online Oral Presentation Guidelines

- Online Oral Presentation will be conducted via Microsoft Teams Meeting.
- All presenters are requested to reach the Online Session Room prior to the schedule time and complete their presentation on time.
- **All presentation times are shown in China Standard Time (GMT/UTC+8:00).**
- If a presenter is not able to show up via Teams, the session chair / conference secretary will play the pre-recorded video presentation during his/her scheduled presentation time, if listeners have questions about the presentation, please contact the conference secretary to forward the questions.
- If a presenter cannot show up on time or have problem with internet connection, the session chair has the right to rearrange his/her presentation, and let the next presentation start.
- Signed and stamped electronic presentation certificate would be issued via e-mail after presentation.

Best Oral Presentations Selection

The session chair will select one best presentations from his/her session based on the following criteria:

- ✓ Research Quality
- ✓ Presentation Performance
- ✓ Presentation Language
- ✓ PowerPoint Design
- ✓ **Effective Communications**

Best Oral Presentations Award

The Best Oral Presenter from each session will receive an official certificate and a free registration to the AMICS 2023.

Session 1_ Applied Mathematics Part A

Session Time: 14:00-17:00 December 6th, 2022 (China Standard Time (UTC/GMT+8:00)
Session Room Link: *http://www.academicconf.com/teamslink?confname=AMICS2022*
Session Chair: Dr. Aparna Rawat, JAIN University (Deemed-to-be), India

14:00-14:20	AIC1099	Extensions of antipodal-type theorems *Dr. Viacheslav Kalashnikov, Tecnológico de Monterrey (ITESM), Campus Monterrey, Mexico*
14:20-14:35	AIC1101	Mexican hat wavelet transform of generalized functions in G ' spaces *Dr. Aparna Rawat, JAIN University (Deemed-to-be), India*
14:35-14:50	AIC1032 (Video)	Existence and uniqueness results in Sobolev space for initial value problem of nonlinear fractional equation *Dr. Chahra Kechar, University of Souk Ahras, Algeria*
14:50-15:05	AIC1088	The isodiametric problem on the sphere and in the hyperbolic space *Mr. Ádám Sagmeister, Eötvös Loránd University, Institute of Mathematics, Hungary*
15:05-15:25	AIC1038 (Video)	Stratifications of the moduli space of Higgs bundles over a Riemann surface *Dr. Álvaro Antón-Sancho, Catholic University of Avila, Spain*
15:25-15:45	AIC1097	Numerical resolution of the nonlinear fredholm integral equation in l1 using a new integration product method *Dr. Kaboul Hanane, University Biskra, Algeria*
15:45-15:55		**BREAK**
15:55-16:10	AIC1104	Continued fractions arising from F1,3 *Dr. Seema Kushwaha, Indian Institute of Information Technology Allahabad, Prayagraj, India*
16:10-16:30	AIC1102	Superoptimal analytic approximants through pointwise wedge products *Dr. Dimitrios Chiotis, Euler International Mathematical Institute, Russian Federation*
16:30-16:45	AIC1020	Enumeration formulae for self-orthogonal, self-dual and LCD codes over finite commutative chain rings *Dr. Monika Yadav, Indraprastha Institute of Information Technology Delhi, India*
16:45-17:00	AIC1081	In tree type flow of impulsive differential equations and their asymptotic stability *Dr. Zsolt Lipcsey, Department of Mathematics, University of Calabar, Nigeria*

Abstracts of Oral Session 1

AIC1099 Extensions of antipodal-type theorems

Viacheslav Kalashnikov[1], Nataliya Kalashnykova[2*], Lilia Alanís-López[3] and Adolphus J.J. Talman[4]
[1] *Tecnológico de Monterrey (ITESM), Campus Monterrey, Monterrey, NL, Mexico*
[2] *Universidad Auónoma de Nuevo León (UANL), San Nicolás de los Garza, NL, Mexico*
[3] *Universidad Autónoma de Nuevo León (UANL), San Nicolás de los Garza, NL, Mexico*
[4] *School of Economics and Management, Tilburg University, Tilburg, The Netherlands*
[*] *Corresponding author: kalash@tec.mx*

Abstract. The central problems of this talk are extensions of certain antipodal and fixed-point theorems to the cases of non-convex sets (star-shaped sets, to be more exact). The techniques used in the fixed-point theorems are widely used in Operations Research, Mathematical Programming, Theory of Games and in many other areas of Optimization Theory and its Applications. These techniques are appropriate when establishing the existence of solutions in the problems of Mathematical Programming, Convex Games, mathematical programs with equilibrium constraints (MPEC), naming only few of the areas of applications. Because of that, any extensions of the classical theorems of fixed points (like the theorem by Brouwer for the single-valued functions and the theorem by Kakutani for multi-valued functions) are very interesting, important and enjoy numerous applications.
The Fixed-Point Theorem by Brouwer and the Theorem by Borsuk-Ulam have been characterized as two powerful topological tools of a very similar structure. In the books of topology such as Krasnosel'sky[1], Herings[2], Yang[3] these two theorems are listed as well as the relationships between them (in fact, the Theorem by Borsuk-Ulam implies the Fixed-Point theorem by Brouwer). The majority of the fixed-point theorems deal with the results for the functions defined over the convex sets. However, in many applied problems, the domains of the involved functions are not necessarily convex; for example, the feasible sets in bilevel programming lack this property even in linear bilevel programming problems (cf., Dempe, S. [4].
This work presents various extensions for the Borsuk-Ulam antipodal theorem and the Browder theorem to the case when the domains of the involved applications are in the star-shaped sets (that is, are not convex) and the structures of the mappings are multi-valued. Even more, this work contains the explicit description of an algorithm of construction of the zero-path, and in this way it extends the Browder theorem.
Keywords: antipodal theorems, star-shaped subsets, triangulation techniques, set-valued mappings

References
[1] Krasnosel'skii, M.A. (1964), Topological Methods in the Theory of Nonlinear Integral Equations. Pergamon Press, Oxford.
[2] Herings, P.J.-J. (1996), Static and Dynamic Aspects of General Equilibrium Theory. Kluwer Academic Publishers, Boston.
[3] Yang, Z.F. (1999), Computing Equilibria and Fixed Points. Kluwer Academic Publishers, Boston.
[4] Dempe, S. (2002), Foundations of Bilevel Programming. Kluwer Academic Publishers, Boston.

AIC1101 Mexican hat wavelet transform of generalized functions in G' spaces

Aparna Rawat[1*] and Abhishek Singh[2]
[1] *JAIN University (Deemed-to-be), Bangalore, India*
[2] *Banasthali Vidyapith, Rajasthan, India*
[*] *Corresponding author: rawataparna18@gmail.com*

Abstract. In this paper, we study the Mexican hat wavelet transform (MHWT) of generalized function

space G' by applying certain advanced conditions developed by Howell (J. Math. Anal. Appl. 180 (1993) 79–92; 187 (1994). The testing function space G is constructed by purely entire functions with some advanced growth conditions whereas its dual G' consists of smooth complex-valued functions of a single real variable. Besides the formulation of all the fundamental results, a reconstruction formula is also obtained for MHWT. Further, we study the characterization of the MHWT of the elements of G and G' .

Keywords: Mexican hat wavelet transform, wavelet transform, weierstrass transform, generalized functions

AIC1032 Existence and uniqueness results in Sobolev space for initial value problem of nonlinear fractional equation

Chahra Kechar [1*], Abdelouaheb Ardjouni [2]
[1] *Department of Mathematics and Informatics, University of Souk Ahras, Algeria*
[2] *Applied Mathematics Lab, Faculty of Sciences, Department of Mathematics, University of Annaba, Algeria*
**Corresponding author: chahra95kechar@gmail.com*

Abstract. In the last decade, fractional calculus became very interesting area of research. Many researchers studied and published a thousands of papers in this field. So, fractional calculus is attracting attention of researchers and specially because of the fact that fractional order derivatives are the better term to describe many different real phenomena. Differential equations involving fractional derivatives are therefore more appropriate for characterizing many models in various fields of applied science and engineering, such as dielectric polarization, dynamics of fluid mechanics, viscoelasticity, electro-chemistry, bioengineering, chaotic dynamics, etc. In this paper, we use the fixed point theorems in Sobolev space to obtain the existence and uniqueness of solutions for certain types fractional differential equations involving Riemann--Liouville derivative. We use also the method of lower and upper solutions and succeeded to establish our results.

Keywords: fractional differential equations, initial value problem, existence, uniqueness, weighted sobolev space, mittag-leffler function, fixed point theory

AIC1088 The isodiametric problem on the sphere and in the hyperbolic space

Károly J. Böröczky[1], Ádám Sagmeister[2*]
[1] *Alfréd Rényi Institute of Mathematics, Hungary*
[2] *Eötvös Loránd University, Institute of Mathematics, Hungary*
[*] *Corresponding author: sagmeister.adam@gmail.com*

Abstract. The isodiametric inequality in the Euclidean space was proved by Bieberbach and Urysohn; namely, balls maximize the volume of a convex body of given diameter. We use a transformation, called two-point symmetrization to extend this result to all spaces of constant curvature. We also prove a stability version of the isodiametric inequality.

Keywords: metric geometry, convex geometry, hyperbolic geometry, spherical geometry, isodiametric problem, two-point symmetrization

Acknowledgements
Károly J. Böröczky and Ádám Sagmeister are supported by NKFIH project K 132002.

AIC1038 Stratifications of the moduli space of Higgs bundles over a Riemann surface

Álvaro Antón-Sancho*
School of Education 'Fray Luis de León', Catholic University of Avila, Spain
**Corresponding author: alvaro.anton@frayluis.com*

Abstract. Let X be a complex Riemann surface of genus $g \geq 2$. A Higgs bundle over X is a pair (E, φ) where E is a holomorphic vector bundle and $\varphi: E \to E \otimes K$ is a homomorphism of bundles, K being the canonical line bundle over X. Higgs bundles are topologically classified by their rank, r, and their degree, d. The slope of the Higgs bundle is called the slope of the associated vector bundle, i.e., the quotient $\mu(E) = \frac{r}{d}$. Thus, a Higgs bundle is called stable (resp. semiestable) if $\mu(F) < \mu(E)$ (resp. $\mu(F) \leq \mu(E)$) for any proper φ-invariant subbundle F of E, and it is polystable if E can be written as a direct sum of φ-invariant stable subbundles, all of them with the same slope, which coincides with the slope of E. The space $M(r, d)$ of isomorphism classes of Higgs bundles over X is an algebraic variety called the moduli space of Higgs bundles. Given a rank r Higgs bundle (E, φ), the vector bundle E admits the so-called Harder-Narasimhan filtration:

$$0 = E_0 \subset E_1 \subset \cdots \subset E_{n-1} \subset E_n = E$$

The successive quotients E_i/E_{i-1} $(i = 1, \dots, n)$ are semistable bundles and their slopes are decreasing. The vector of these slopes is called the Harder-Narasimhan type of the Higgs bundle and is an invariant of its isomorphism class. The space $M(r, d)$ admits a stratification defined by the equality of this vector of slopes, called Shatz stratification. On the other hand, $\mathbb{C}^*$ acts on $M(r, d)$ by multiplication in the second member, $\lambda \cdot (E, \varphi) = (E, \lambda\varphi)$. The decomposition into irreducible components of the subvariety of $M(r, d)$ of fixed points for the $\mathbb{C}^*$-action induces another stratification of $M(r, d)$, defined through the limits $\lim_{z \to 0}(E, z\varphi)$, which are always semistable Hodge bundles fixed for the $\mathbb{C}^*$-action. This is called Bialynicki-Birula stratification. Hausel proved that the Shatz and Bialynicki-Birula stratifications coincide when $r = 2$. Subsequently, Zúñiga-Rojas reached the same result employing different techniques. However, Gothen and Zúñiga-Rojas proved that there is no such coincidence between the two stratifications when $r = 3$. The results presented here prove that these stratifications also do not coincide at rank 4 and that, in this case, each Shatz stratum is crossed by different Bialynicki-Birula strata. In addition, sufficient conditions on the Harder-Narasimhan type of (E, φ) for the Shatz and Bialynicki-Birula stratifications of the corresponding irreducible component coincide are stated as a consequence of the above results.
Keywords: Higgs bundle, stratification, moduli space, Shatz stratification, Bialynicki-Birula stratification

AIC1097 Numerical resolution of the nonlinear fredholm integral equation in L1 using a new integration product method

Kaboul Hanane*
Department of Mathematics, University Biskra, Algeria
**Corresponding author: hanane.kaboul@univ-biskra.dz*

Abstract. The product integration method is one of the well known methods using to solve linear Fredhom integral equations with weakly singular kernel in case of smooth solution. We present new product integration method, that we can use even the solution is just L1.In the nonlinear case, we propose to start by the linearization of the equation using the Newton method and then we approximate the solution by the product integration method that we propose for linear equations. We prove the

convergence of the approximate solution to the exact one, and we support our result by numerical example.

Keywords: nonlinear Fredholm equation of the second kind, Newton method, product integration method

AIC1104 Continued fractions arising from F1,3

S. Kushwaha* and R. Sarma
[1] *Indian Institute of Information Technology Allahabad, India*
[2]*Indian Institute of Technology Delhi, India*
**Corresponding author: seema28k@gmail.com*

Abstract. We study a family of continued fractions arising from a graph known as F1,3 which is isomorphic to a subgraph of the Farey graph. We call these continued fractions F1,3-continued fractions. In fact, certain paths from infinity to a vertex in F1,3 correspond to finite F1,3-continued fractions of the vertex and vice versa. Further, we study uniqueness of the longest F1,3-continued fraction expansions of real numbers and show that their convergents are best approximations of the numbers by vertices of F1,3.

Keywords: continued fraction, convergents, best approximation, farey graph

AIC1102 Superoptimal analytic approximants through pointwise wedge products

Dimitrios Chiotis[1*], Zinaida A. Lykova[2] and Nicholas J. Young[3]
[1] *Euler International Mathematical Institute, St Petersburg, Russia*
[2] *School of Mathematics, Statistics and Physics, Newcastle University, Newcastle, UK*
[3] *School of Mathematics, Statistics and Physics, Newcastle University, Newcastle, UK*
**Corresponding author: chiotisd@gmail.com*

Abstract. Let G be a Lebesgue measurable matrix-valued function on the unit circle $\mathbb{T}$. The superoptimal analytic approximation problem entails determining a bounded analytic matrix-valued function Q on the unit disc $\mathbb{D}$ such that the sequence

$$s^{\infty}(G-Q) = (s_0^{\infty}(G-Q), s_1^{\infty}(G-Q), s_2^{\infty}(G-Q), \dots)$$

is lexicographically minimised over all bounded analytic matrix-valued functions. Here $s_j^{\infty}(G-Q) = \operatorname{esssup}_{z\in\mathbb{T}} s_j(G(z)-Q(z))$ and $s_j(G(z)-Q(z))$ denotes the j-th singular value of the matrix $G(z)-Q(z)$. The functions that lexicographically minimise the sequence above are called the superoptimal analytic approximants of G, and are almost never unique; Peller and Young in 1994 proved that if G belongs to $H^{\infty}+C$, then there exists a unique superoptimal analytic approximant of G. Besides their importance from a pure mathematics viewpoint, these approximants of matrix functions arise also in the context of H^{∞} control theory. Specifically, in robust stabilisation one of the problems requires computation of a controller which minimises the L^{∞}-norm of an assigned closed-loop transfer function. Then, it transpires that the superoptimal solution substantiates optimal robustness towards all possible directions. Hence the calculation of the superoptimal function is of high significance, resulting in the introduction of several algorithms. Limebeer, Halikias and Glover in 1989 developed a superoptimal algorithm based on state space methods, whereas Peller and Young in 1995 produced a conceptual superoptimal algorithm based on thematic completions of inner vector-valued functions. In this talk we present our construction of an operator-theoretic superoptimal algorithm[1] which employs pointwise wedge products of Hilbert spaces [2] along with the compactness of certain Hankel-type operators. The talk is based on joint work with Z.A. Lykova and N.J. Young.

Keywords: superoptimal approximation, exterior products, wedge products, Hilbert function spaces, Hardy spaces

References

[1] D. Chiotis, Z.A. Lykova, N.J. Young, *Exterior products of operators and superoptimal analytic approximation*, Trans. Lond. Math. Soc. **8**, 1 (2021).
[2] D. Chiotis, Z.A. Lykova, N.J. Young, *Exterior powers and pointwise creation operators*, Complex Anal. Oper. Theory **15**, 29 (2021).

AIC1020 Enumeration formulae for self-dual, self-orthogonal and LCD Codes over finite commutative chain rings

Monika Yadav[1], Anuradha Sharma[2]
Indraprastha Institute of Information Technology Delhi, New Delhi, India
Corresponding authors: monikay@iiitd.ac.in (M. Yadav), anuradha@iiitd.ac.in (A. Sharma)

Abstract. Self-orthogonal, self-dual and linear with complementary dual (LCD) codes constitute the three most important and well-studied classes of linear codes having rich algebraic structures. Self-orthogonal and self-dual codes have nice connections with the theory of modular forms and unimodular lattices, and LCD codes have several applications in cryptography, consumer electronics and data storage. In this talk, we will present explicit enumeration formulae for self-orthogonal, self-dual and LCD codes of an arbitrary length over finite commutative chain rings. These enumeration formulae are useful in classifying these three classes of linear codes over finite commutative chain rings up to equivalence. By applying the classification algorithm and using these enumeration formulae, we will classify all self-orthogonal, self-dual and LCD codes of particular lengths over certain special chain rings. Besides this, we will show that the class of LCD codes over finite commutative chain rings is asymptotically good, and that every free linear [n, k, d]-code over a finite commutative chain ring is equivalent to an LCD [n, k, d]-code over finite commutative chain ring.
Keywords: linear codes, classification algorithm, witt decomposition theory

AIC1081 In tree type flow of impulsive differential equations and their asymptotic stability

Zsolt Lipcsey*
Department of Mathematics, University of Calabar, Nigeria
**Corresponding author:*lipzsoltt@gmail.com

Abstract. We proved that the flow of solutions of impulsive differential equations forms an in-tree and not a stream like flow. This follows from the fact that the Lipschitz condition is fulfilled in one direction only and that the solution exists in one direction only – there are solutions which have no past, continuation in the negative direction. The algebraic structure of the solutions therefore offer interesting consequences like the set of trajectories is split into partitions based on pairwise disjoint sets of initialization. When asymptotic stability is considered, the set of all initial value problems is split up into as many pairwise disjoint sets as many asymptotic limits the equation has. These may offer modeling of spread of diseases, population studies etc. In the paper we present classifications of solutions based on the properties of initial value problems, and specific asymptotic stability problems like characterization of asymptotic structures by various properties of initial value problems.

Session 2_ Applied Mathematics Part B

Session Time: 14:00-17:15 December 6th, 2022 (China Standard Time (UTC/GMT+8:00)

Session Room Link:

http://www.academicconf.com/teamslink?confname=AMICS2022&sessionid=2

Session Chair: Dr. Bhagwat Ram, Indian Institute of Management Ahmedabad, India

14:00-14:15	AIC1057	Backwards semi-martingales into Burgers' turtulence *Dr. Nzissila Florent, Department of Mathematics, University of Sciences and Technologies of Masuku, Gabon*
14:15-14:30	AIC1083	Repeated burst error and its variants *Dr. Rashmi Verma, Mata Sundri College for Women (University of Delhi), India*
14:30-14:50	AIC1086 (Video)	Varieties generated by *p*-groups and *Kp*-series *Dr. Vahagn H. Mikaelian, Yerevan State University, Armenia*
14:50-15:05	AIC1035	Strong convergence of the gradients for $p-$Laplacian problems as p goes to infinite *Dr. Stefano Buccheri, Faculty of Mathematics and Economy, University of Vienna, Austria*
15:05-15:20	AIC1077	A new family of solids: the infinite Kepler-Poinsot polyhedra *Dr. Dirk Huylebrouck, KU Leuven, Belgium*
15:20-15:40	AIC1095	A q-spectral polak-ribiére-polyak conjugate gradient method for unconstrained optimization problems *Dr. Bhagwat Ram, Indian Institute of Management Ahmedabad, India*
15:40-15:55	AIC1073	Encompassing approaches: asymptotic properties and illustration on macroeconomic modeling and on forecast combination *Dr. Patrick Rakotomarolahy, University of Fianarantsoa, Madagascar*
15:55-16:05		**BREAK**
16:05-16:20	AIC1060	Some remarks on the Metrizability of $\mathcal{F}$-metric spaces *Dr. Sumit Som, Department of Mathematics, School of Basic and Applied Sciences, Adamas University, Barasat-700126, West Bengal, India*
16:20-16:40	AIC1034	On the local convergence of two-step newton type method in banach spaces under generalized lipschitz conditions *Dr. J. P. Jaiswal, Guru Ghasidas Vishwavidyalaya (A Central University), India*
16:40-16:55	AIC1091	Volume of Fluid (VOF) modeling of liquid film evaporation in mixed convection flow through a vertical channel *Dr. Hayat El Baamrani, Ibn Zohr University, Morocco*
16:55-17:15	AIC1004	Effect of magnetic field on hydrodynamic permeability of biporous membrane relative to micropolar liquid flow *Dr. Deepak Kumar Maurya, Veer Bahadur Singh Purvanchal University, India*

Abstracts of Oral Session 2

AIC1057 Backwards semi-martingales into Burgers' turtulence

Nzissila Florent
Department of Mathematics, University of Sciences and Technologies of Masuku, Gabon
Corresponding author: nzissilaflorent@gmail.com

Abstract. In fluid dynamics governed by the one dimensional inviscid Burgers equation, the stirring is explained by the sticky particles model. A Markov process describes the motion of random turbulent intervals which evolve inside another Markov process, describing the motion of random clusters concerned with the turbulence. Then, the four velocity processes that flow from this construction are backward semi-martingales. If one of them is a martingale, then any turbulent interval is reduced to a single point.
Keywords: burgers equation, optional time, semi-martingale, sticky particle dynamics, turbulence

AIC1083 Repeated Burst Error and Its Variants

Rashmi Verma*
Department of Mathematics, Mata Sundri College for Women (University of Delhi), India
**Corresponding author: rashmiv710@gmail.com*

Abstract. In the theory of error correcting codes, there are many kinds of errors for which codes have been developed to combat such errors. Apart from random error, one of the widely studied error is a burst error. The nature of burst errors differ from channel to channel depending upon the type of channels or the kind of errors which occur during the process of data transmission. Repeated burst error was introduced by Dass and Verma in 2008. Codes that can detect and correct repeated burst errors have been discussed. Several bounds on the number of parity-check digits required for codes dealing with the detection and correction of such errors have been obtained. An easy and new method for the construction of a parity-check matrix of a repeated burst error correcting linear code is presented. Illustrations of codes detecting and correcting such errors have been provided. The study of repeated burst error detecting and correcting codes is important not only from mathematical point of view as a generalization of burst but also because these codes might be helpful in other subject areas viz., mathematical biology. Some variants and modifications of the definition of a repeated burst error by several other researchers have been discussed.
Keywords: Error correcting code, parity-check matrix, burst error, low-density burst
Acknowledgements: The research work has been carried out under the supervision of Prof. B.K. Dass, Department of Mathematics, University of Delhi, Delhi, India.

AIC1086 Varieties generated by p-groups and Kp-series

Vahagn H. Mikaelian*
Yerevan State University, Armenia
**Corresponding author: v.mikaelian@gmail.com*

Abstract. For a prime p let A be a nilpotent p-group of finite exponent and B be an abelian p-group of finite exponent. Then the wreath product A Wr B generates the product variety var(A) var(B) if and only if the group B contains a the direct product of countably many copies of the cycle C_n where n is

the exponent of B. This result continues our previous study of cases when var(A Wr B) = var(A) var(B) holds for certain other classes of groups A and B, such as, abelian groups, finite groups, etc.
Keywords: varieties of groups, wreath products, products of varieties, subvarieties, p-groups, Kp-series
Mathematics Subject Classification: 20E22, 20E10, 20K01, 20K25, 20D15

AIC1035 Strong convergence of the gradients for $p-$Laplacian problems as $p\to \infty$

Stefano Buccheri*, Tommaso Leonori, Julio Rossi
Faculty of Mathematics and Economy, University of Vienna, Vienna, Austria
*Corresponding author: stefano.buccheri@univie.ac.at

Abstract. Faculty of Mathematics and Economy, University of Vienna, Vienna, Austria
In this paper we prove that the gradients of solutions to the Dirichlet problem for $-\Delta_{p} u_p = f$, with $f>0$, converge as $p\to \infty$ strongly in every L^q with $1\leq q < \infty$ to the gradient of the limit function. This convergence is sharp since a simple example in 1-d shows that there is no convergence in L^∞. For a nonnegative f we obtain the same strong convergence inside the support of f. The same kind of result also holds true for the eigenvalue problem for a suitable class of domains (as balls or stadiums).

AIC1077 A new family of solids: the infinite Kepler-Poinsot polyhedra

Dirk Huylebrouck*
Faculty for Architecture, KU Leuven, Hoogstraat 51, 9000 Gent, Belgium
Corresponding author: dirk.huylebrouck@kuleuven.be

Abstract. The classical families of polyhedra refer to the Greek Plato and Archimedes. If they were the first to have discovered them is a matter of discussion, as a 14-sided die resembling a truncated octahedron as well as other dice were found in the Shandong Province, dating from the Warring States era (c. 475–221 BC). In any case, here the focus is on polyhedra allowing intersecting faces, such as the small and great stellated dodecahedron described Kepler in 1619, and the great dodecahedron and great icosahedron discovered by Poinsot in 1809. All four are regular, like the Platonic solids, in the sense that the regular polygons covering them are identical as well as the spatial angles between them. In 20th century, Coxeter and Petrie added three more regular polyhedra using infinitely repeating elements, based on the truncated tetrahedron, the cube and the truncated octahedron. The principle of intersecting faces, typical for the Kepler-Poinsot solids, can be combined with the Coxeter-Petrie infinite generalization. Thus, a new regular polyhedron was discovered, based on the cubohemioctahedron, without its square faces. Putting them side by side and on top of each other, identical regular hexagons meet in each vertex, always with the same spatial angle. There are 8 of them in each vertex, and so it is not a compound of twice two solids with 4 hexagons in each vertex. The present paper explores other examples of (non-regular) infinite Kepler-Poinsot solids as well. The generalization of Arthur Cayley's formula (19th century) for the regular Kepler-Poinsot polyhedra to these infinite case remains open.

AIC1095 A q-Spectral Polak-Ribiére-Polyak conjugate gradient method for unconstrained optimization problems

Bhagwat Ram*
Centre for Digital Transformation, Indian Institute of Management Ahmedabad, India
Corresponding author: bhagwatram14@gmail.com

Abstract. Frank Hilton Jackson generalized the concepts of derivative in the q-calculus context and created the q-derivative, widely known as Jackson's derivative. In this paper, we propose a q-variant of the spectral Polak-Ribiére-Polyak (PRP) conjugate gradient method for solving unconstrained optimization problems. The method can be viewed as a generalization of the spectral PRP method which uses a q-gradient vector that is similar to the usual gradient vector, but instead of the usual first-order partial derivatives, it uses the first-order partial q-derivatives obtained from Jackson's derivative. Moreover, as q approaches 1, the introduced q-variant reduces to the classical version. Numerical experiments are performed and compared with the existing method to show the efficiency of the proposed method. Furthermore, we have solved the motion control problem.
Keywords: unconstrained optimization, q-calculus, conjugate gradient method, line search, global convergence
Acknowledgements: Author acknowledges for getting support from Centre for Digital Transformation, Indoan Institute of Monument Ahmedabad

AIC1073 Encompassing approaches: asymptotic properties and illustration on macroeconomic modeling and on forecast combination

Patrick Rakotomarolahy*
Mention Mathematics and Their Applications, Faculty of Sciences, University of Fianarantsoa, Madagascar
**Corresponding author: rakotopapa@gmail.com*

Abstract. This work contributes to model selection between parametric and nonparametric regression methods through the use of encompassing tests. We provide asymptotic normality of encompassing statistic associated with the encompassing hypothesis for both regression methods. We develop various theoretical results on this test for more general processes satisfying several dependence structures. Moreover, we illustrate the encompassing test on real economic activity modelling and on forecast combination.

AIC1060 Some remarks on the metrizability of $\mathcal{F}$-metric spaces

Sumit Som, Ashis Bera, Lakshmi Kanta Dey*
Department of Mathematics, School of Basic and Applied Sciences, Adamas University, Barasat-700126, West Bengal, India.
**Corresponding author: lakshmikanta.dey@maths.nitdgp.ac.in*

Abstract. In this talk, we will show that the newly introduced $\mathcal{F}$-metric space by Jleli and Samet in [J. Fixed Point Theory Appl., 20(3):128, (2018)] is metrizable. Also, we deduce that the notions of convergence, Cauchy sequence, completeness due to Jleli and Samet for $\mathcal{F}$-metric spaces are equivalent to that of usual metric spaces. Moreover, we show that the Banach contraction principle in the context of $\mathcal{F}$-metric spaces is a direct consequence of its standard metric counterpart.
Keywords: $\mathcal{F}$-metric space, metrizability, Banach contraction principle

AIC1034 On the Local Convergence of Two-Step Newton Type Method in Banach Spaces under Generalized Lipschitz Conditions

J. P. Jaiswal*

Department of Mathematics, Guru Ghasidas Vishwavidyalaya (A Central University), India
**Corresponding author: asstprofjpmanit@gmail.com*

Abstract. The motive of this paper is to discuss the local convergence of a two-step Newton-type method of convergence rate three for solving nonlinear equations in Banach spaces. It is assumed that the first order derivative of nonlinear operator satisfies the generalized Lipschitz i.e., L-average condition. Also, some results on convergence of the same method in Banach spaces are established under the assumption that the derivative of the operators satisfies the radius or center Lipschitz condition with a weak L-average particularly it is assumed that L is positive integrable function but not necessarily non-decreasing. Our new idea gives a tighter convergence analysis without new conditions. The proposed technique is useful in expanding the applicability of iterative methods. Useful examples justify the theoretical conclusions.
Keywords: Banach space, nonlinear problem, local convergence, lipschitz condition, L-average, convergence ball.

AIC1091 Volume of fluid (VOF) modeling of mixed convection heat and mass transfer in a vertical channel with film evaporation

Hayat El Baamrani*, Lahcen Bammou , Ahmed Aharoune, Abdallah Boukhris
Thermodynamics and Energetics Laboratory, Faculty of Science, Morocco
**Corresponding author: hayatelbaamrani92@gmail.com*

Abstract. In this paper, the volume of Fluid (VOF) method in the OpenFOAM open-source Computational Fluid Dynamics (CFD) package is used to investigate the coupled heat and mass transfer by mixed convection during the evaporation of water-thin film. The liquid film is falling down on the left wall of a vertical channel and is subjected to a uniform heat flux density, whereas the right wall is assumed to be insulated and dry. The gas mixture consists of air and water vapor. The governing equations in the liquid and in the gas areas with the boundary conditions are solved by using the finite volume method. The results which include temperature, velocity, and vapor mass fraction are presented. The effect of heat flux density, liquid inlet temperature, and mass flow rate on the heat and mass transfer are also analyzed.
Keywords: heat and mass transfer, evaporation, mixed convection, volume of fluid (vof), vertical channel

AIC1004 Effect of magnetic field on hydrodynamic permeability of biporous membrane relative to micropolar liquid flow

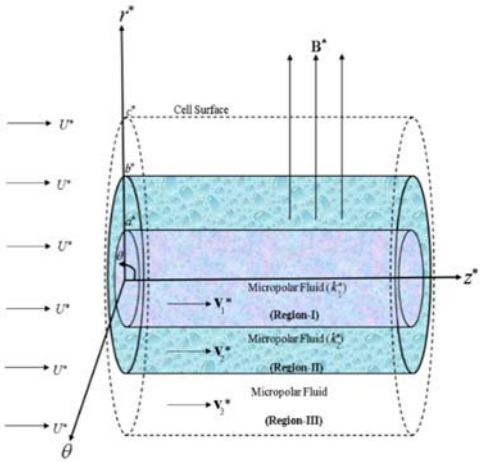
Satya Deo [1], Deepak Kumar Maurya [2, *] and A. N. Filippov [3]
[1] *Department of Mathematics, University of Allahabad, Prayagraj, 211002 (U.P.) India*
[2] *Department of Mathematics, Prof. Rajendra Singh (Rajju Bhaiya) Institute of Physical Sciences for Study and Research, Veer Bahadur Singh Purvanchal University, Jaunpur, 222003, (U.P.), India*
[3] *Department of Higher Mathematics, National University of Oil and Gas "Gubkin University," Moscow, 119991, Russia*
[*] *Corresponding author: deepak893395@gmail.com*

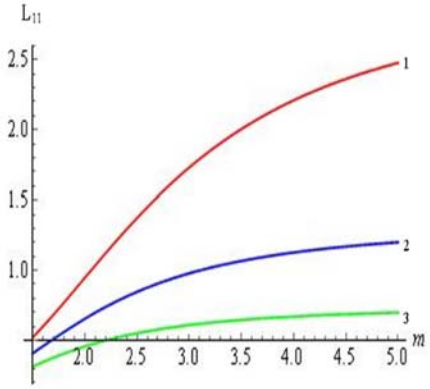
Abstract. The present research work concerns the influence of uniform magnetic field on hydrodynamic permeability of biporous membrane relative to the flow of micropolar liquid using four known cell models namely Happel, Kuwabara, Kvashnin and Mehta–Morse models. At first the governing equations of micropolar liquid were written in Eringen approach and later, using Stokes hypothesis, field equations are expressed in modified form of Eringen's approach. After non-

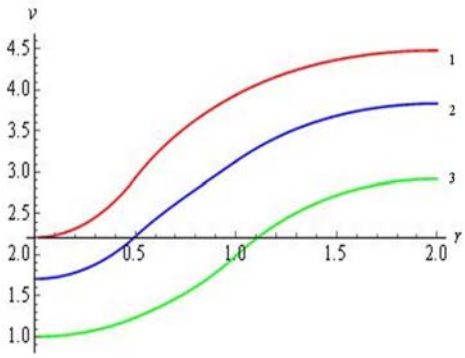
dimensionalise these equations, micropolar fluid velocity, microrotation vectors, shear stresses and couple stresses, which are combinations of modified Bessel functions of first and second kinds, are investigated. Arbitrary integration constants are determined by applying analyticity/regularity condition at origin, continuity of fluid velocities, continuity of microrotational, continuity of shear stress and continuity of tangential stress at the porous interfaces along with an equivalent condition to Happel, Kuwabara, Kvashnin and Mehta–Morse models at the cell surface. Analytical expressions of volumetric flow rate, superficial/filtration velocity and hydrodynamic permeability are reported. The graphs of hydrodynamic permeability, micropolar fluid velocity and microrotation are plotted under the effect of micropolar parameter, Hartmann number, permeability parameters and conductivity ratio parameters, and discussed for different values of these parameters. Applications of the present mathematical fluid flow problems and discussion of results are also reported in the manuscript.

Keywords: micropolar fluid, hartmann number, couple stress, cell models, flow rate

Acknowledgements: Deepak Kumar Maurya acknowledges CSIR, New Delhi, India for the award of JRF No.- 09/001(0423)/2018-EMR-I for carrying this research work.







Session 3_ Algorithms and Fuzzy Mathematics

Session Time: 9:00-12:10 December 7th, 2022 China Standard Time (UTC/GMT+8:00)
Session Room Link: *http://www.academicconf.com/teamslink?confname=AMICS2022*
Session Chair: Dr. Suman Maity, Raja N.L. Khan Women's College (Autonomous), India

09:00-09:20	AIC1096 (Video)	Fast algorithms for black-box global optimization *Prof. Dmitri E. Kvasov. University of Calabria, Italy*
09:20-09:40	AIC1021 (Video)	Multifactor RSA-like scheme exploiting the pell equation *Prof. Nadir Murru, University of Trento, Italy*
09:40-09:55	AIC1093	An enhanced algorithm for soft-hard scheduling on multiprocessor platforms *Dr. Stefan Andrei, Lamar University, USA*
09:55-10:15	AIC1094	An efficient algorithm for numerical inversion of system of generalized singular integral equations *Dr. Sandeep Dixit, School of Engineering, UPES, India*
10:15-10:30	AIC1105	Vibration Analysis of Curved Nanobeams and Nanoarches *Mr. Shahid Mubasshar, Institute of Mathematics and Statistics, University of Tartu, Estonia*
10:30-10:40	**BREAK**	
10:40-11:00	AIC1070 (Video)	A seventh order iterative algorithm to find a root of transcendental equations *Prof. Srinivasarao Thota, SR University, India*
11:00-11:15	AIC1084	A new defuzzification method for solving fuzzy mathematical programming problems *Prof. Amin Vahidi, Shahid Beheshti University, Iran*
11:15-11:35	AIC1002	A study of an EOQ model with public-screened discounted items under cloudy fuzzy demand rate *Dr. Suman Maity, Raja N.L. Khan Women's College (Autonomous), India*
11:35-11:50	AIC1048	Identification of the meteorological objects on doppler-polarimetric radar data by using fuzzy logic-based algorithm *Dr. Alexander Pitertsev, National Aviation University, Ukraine*
11:50-12:10	AIC1026	Implicit scheme for variational inequalities over the fixed point set of an asymptotically non-expansive mapping in intermediate sense *Dr. Rajat Vaish, Amity University Madhya Pradesh, India*

Abstracts of Oral Session 3

AIC1096 Fast algorithms for black-box global optimization

Dmitri E. Kvasov [*]
DIMES, University of Calabria, Italy
**Corresponding author: kvadim (at) dimes.unical.it*

Abstract. Global optimization of expensive black-box functions is a numerically challenging problem that often cannot be solved by traditional optimization techniques. Because of high computational costs involved, a researcher is typically interested in performing only a limited number of costly function evaluations. Therefore, the main goal is to develop fast global optimization algorithms that produce practically good solutions with a limited number of function (and constraints) evaluations. In this talk, advanced deterministic approaches for solving black-box global optimization problems based on the Lipschitz continuity assumption are discussed and their application to studying several real-life decision-making problems is shown.
Keywords: expensive global optimization, deterministic methods, metaheuristics

AIC1021 Multifactor RSA-like scheme exploiting the Pell equation

Nadir Murru[*]
University of Trento, Italy
[*]*Corresponding author: nadir.murru@unitn.it*

Abstract. RSA-like schemes are variants of the classical public key scheme RSA exploiting some groups defined over curves together to a parametrization. These schemes have been proposed in order to avoid some attacks to the RSA scheme (like in broadcast scenarios) and a decryption procedure two times faster than RSA. We present an RSA-like scheme based on the group structure of the Pell conic with a parametrization which allows to exploit the Rédei functions for performing the exponentiations. Moreover, we see variants of this scheme involving modulus with more than two factors, which allow to achieve faster schemes. These variants are usually called Multifactor RSA and Multiprime RSA. The decryption procedure of our schemes appear to be faster than other RSA-like schemes based on curves, since a low number of modular inversions are involved. Keywords: RSA, Pell equation, Rédei functions, public-key cryptography

AIC1093 An enhanced algorithm for soft-hard scheduling on multiprocessor platforms

Ştefan Andrei [1], Albert M.K. Cheng [2] and Vlad Rădulescu [3]
[1] *Lamar University, Beaumont, TX, USA*
[2] *University of Houston, Houston, TX, USA*
[3] *A. I. Cuza University, Iaşi, Romania*

Abstract. The last years have witnessed a continuous effort of the real-time research community to develop new models, capable of getting a more accurate view of real-world problems. Moving beyond the frame of traditional approaches, more flexible deadline-handling models have emerged, including *(m, k)*-firm deadlines, task execution to multiple feasible intervals, or mixed-criticality systems. This paper makes use of a recently proposed model, in which each task has two deadlines. While the hard deadline still requires to be met in all circumstances, the soft deadline acts as a measure of the quality of the schedule, making a difference between acceptable behavior and desirable behavior for a task set. Such a model requires an adaptation of the scheduling algorithm, in order to keep track of both sets of

deadlines. The paper focuses on enhancing an existing algorithm, by extending a task inversion technique to multiple levels. Experimental results show that task inversion enhancement is highly effective, and even more so as the complexity of the task set is growing.
Keywords: soft and hard deadlines, non-preemptive scheduling, multiprocessor scheduling

AIC1094 An efficient algorithm for numerical inversion of system of generalized singular integral equations

Sandeep Dixit*
Department of Mathematics, School of Engineering, UPES, Dehradun, Uttarakhand, India
**Corresponding author: sdixit@ddn.upes.ac.in*

Abstract. In this article a direct method is introduced, which is based on orthonormal Bernstein polynomials, to present an efficient and stable algorithm for numerical inversion of the system of singular integral equations of Abel type. The appropriateness of earlier numerical inversion methods was restricted to the one portion of singular integral equations of Abel type. The proposed method is absolutely accurate, and numerical illustrations are given to show the convergence and utilization of the suggested method and comparisons are made with some other existing numerical solution
Keywords: Bernstein polynomials, Abel inversion, operational matrix, system of generalized, Abel integral equations

AIC1105 Vibration Analysis of Curved Nanobeams and Nanoarches

Shahid Mubasshar*, Jaan Lellep
Institute of Mathematics and Statistics, University of Tartu, Estonia
Corresponding author: shahid.mubasshar@ut.ee

Abstract. A numerical solution is developed for simply supported nanoarches based on the non-local theory of elasticity. The nanoarch under consideration has a step-wise variable cross-section and is weakened by crack-like defects. It is assumed that the cracks are stationary and the mechanical behaviour of the nanoarch can be modelled by Eringen's non-local theory of elasticity. The physical and thermal properties are sensitive with respect to changes of dimensions in the nano level. The classical theory of elasticity is unable to describe such changes in material properties. This is because, during the development of the classical theory of elasticity, the speculation of molecular objects was avoided. Therefore, the non-local theory of elasticity is applied to study the vibration of nanostructures and it has been accepted by many researchers. In the non-local theory of elasticity, it is assumed that the stress state of the body at a given point depends on the stress state of each point of the structure. However, within the classical theory of elasticity, the stress state of the body depends only on the given point. The system of main equations consists of equilibrium equations, geometrical relations and constitutive equations with boundary and intermediate conditions. The system of equations is solved by using the method of separation of variables. Consequently, the governing differential equations are converted into a system of algebraic equations whose solution exists if the determinant of the coefficients of the matrix vanishes. The influence of cracks and steps on the natural vibration of the nanoarches is prescribed with the aid of additional local compliance at the weakened cross-section. An algorithm to determine the eigenfrequencies of the nanoarches is developed with the help of computer

software. The effects of various physical and geometrical parameters are recorded and drawn graphically

Keywords: Crack, nanoarches, natural frequency, step

AIC1070 A seventh order iterative algorithm to find a root of transcendental equations

Srinivasarao Thota*
Department of Mathematics, School of Sciences, SR University, Warangal, Telengana-506371, India
**Corresponding author: srinithota@ymail.com, srinivasarao.thota@sru.edu.in*

Abstract. Applications of various fields of pure and applied sciences and technology, engineering arise in the form non-linear equations $f(x) = 0$; and many engineers and researchers have been discussed and created several hybrid algorithms to solve nonlinear equations numerically using the well-known classical root finding algorithms. In this talk, we discuss a seventh order iterative method/algorithm for solving the given transcendental equation. The main idea of the proposed algorithm id based on the modified homotopy perturbation technique. Analysis of converges of the proposed algorithm is also present. An example is discussed to validate and illustrate the proposed algorithm and MS Excel Implementation is presented with sample computations. Using MS Excel spreadsheet, one can makes numerical methods easier to calculate the manual calculations.

Keywords: numerical algorithms, hybrid algorithms, transcendental equations, nonlinear algebraic equations, microsoft excel

AIC1084 A new defuzzification method for solving fuzzy mathematical programming problems

Amin Vahidi[*]
Shahid Beheshti University, Iran
[*]*Corresponding author: amin.vahidi@gmail.com*

Abstract. Solving a certain type of Fuzzy mathematical programming (FMP) require several steps and manual intervention in the solution process. Therefore, it reduces the optimality and increases the solving time. In this research, a methodology is presented that, in addition to being applicable to all types of FMPs, increases optimality and reduces the solving time. The proposed method generates improved solutions in less time and requires less monitoring during the problem-solving procedure.

Keywords: linear programming, fuzzy programming, mathematical programming

AIC1002 A study of an EOQ model with public-screened discounted items under cloudy fuzzy demand rate

Suman Maity[1,*], Sujit Kumar De[2], Madhumangal Pal[3] and Sankar Prasad Mondal[4]
[1]*Department of Mathematics, Raja N.L. Khan Women's College (Autonomous), Paschim Medinipur-721101, W.B. India*
[2]*Department of Mathematics, Midnapore College (Autonomous), Paschim Medinipur-721101, W.B. India*
[3]*Department of Applied Mathematics with Oceanology and computer programming, Vidyasagar University, Paschim Medinipur-721102, W.B. India*
[4]*Department of Applied Science, Maulana Abul Kalam Azad University of Technology, Haringhata,*

Nadia-741249, W.B, India
**Corresponding author: maitysuman2012@gmail.com*

Abstract. This article deals with an economic order quantity inventory model of imperfect items under non-random uncertain demand. Here we consider the customers screen the imperfect items during the selling period. After a certain period of time, the imperfect items are sold at a discounted price. We split the model into three cases, assuming that the demand rate increases, decreases, and is constant in the discount period. Firstly, we solve the crisp model, and then the model is converted into a fuzzy environment. Here we consider the dense fuzzy, parabolic fuzzy, degree of fuzziness and cloudy fuzzy for a comparative study. The basic novelty of this paper is that a computer-based algorithm and flow chart have been given for the solution of the proposed model. Finally, sensitivity analysis and graphical illustration have been given to check the validity of the model.
Keywords: imperfect inventory, dense fuzzy number, parabolic fuzzy number, cloudy fuzzy number, degree of fuzziness, optimization

AIC1048 Identification of the meteorological objects on doppler-polarimetric radar data by using fuzzy logic based algorithm

A.A. Pitertsev*, F.J. Yanovsky
National aviation university, Kyiv, Ukraine
**Corresponding author: pitertsev@gmail.com*

Abstract. This article deals with the process of identification of dangerous meteorological objects. Zones of aircraft icing-in-flight and atmosphere turbulence are among them. Hydrometeors, such as water droplets and ice crystals, scatter incident electromagnetic waves (EMW). In common case, Doppler-polarimetric variables of backscattered electro-magnetic field depend on the velocity, shape, size, orientation, and type of the scatterers. The problem of simulation of EMW scattering on hydrometeors is rather difficult because a lot of different parameters of scatterers and conditions of sounding should be taken into account. This research does not claim to comprehensive description of all possible solutions of this problem. The key point of this paper is placed on the possibility of polarimetric weather radar to determine the type of hydrometeors in case of homogeneous medium (scatterers of one type) and in case of mixture of different types of scatterers in an ensemble of hydrometeors. The possibility to determine quantitatively the ratio of two types of hydrometeors is also a subject of consideration in this research. This item is especially important for providing flight safety by using both ground-based and airborne weather radars; it can be used particularly, for remote detection probable icing-in-flight zones to prevent icing-in-flight of modern aircrafts
Keywords: radars, hydrometeors, dangerous meteorological objects, aircraft icing

AIC1026 Implicit scheme for variational inequalities over the fixed point set of an asymptotically nonexpansive mapping in intermediate sense

Rajat Vaish
Amity University Madhya Pradesh, Gwalior, M.P., India
Corresponding author: rajatvaish6@gmail.com; rvaish@gwa.amity.edu

Abstract. With the help of the generalized viscosity implicit method and hybrid steepest-descent method, we introduce an iterative scheme for approximating the solution of a variational inequality over the set of fixed points of an asymptotically nonexpansive mapping in the intermediate sense. Some strong convergence results for our proposed iterative scheme are established in the framework of Banach spaces. Applicability of our proposed method is shown in variational inclusion problem and

convex minimization problem. We discuss some examples to demonstrate the numerical implementation and efficiency of our main results in comparison of other related results. Our results improve, extend and unify previously known results given in literature.
Keywords: asymptotically nonexpansive mapping in the intermediate sense, variational inequality, implicit iterative scheme, hybrid steepest-descent method, viscosity approximation method, banach space

Session 4_ Computational Mathematics

Session Time: 14:00-18:20 December 7th, 2022 China Standard Time (UTC/GMT+8:00)
Session Room Link: *http://www.academicconf.com/teamslink?confname=AMICS2022*
Session Chairs:
14:00-16:10 Dr. Kamlesh Kumar Shukla, Noida International University, India
16:20-18:20 Dr. Stefano Buccheri, Faculty of Mathematics and Economy, University of Vienna, Austria

14:00-14:20	AIC1027	On the classification of regular polyhedral complexes *Dr. Fumiko Ohtsuka, Ibaraki University, Japan*
14:20-14:35	AIC1018 (Video)	Robustness of orthogonal uniform composite designs against missing data *Ms. Yankam Mbouamba Brenda, University of Nigeria, Nigeria*
14:35-14:55	AIC1054	Merits of Bayesian networks in overcoming the curse of dimensionality *Dr. Hasna NJAH, University of Sfax, Tunisia*
14:55-15:10	AIC1045 (Video)	Numerical studies of intermittency and crisis-induced intermittency in vibro-impact systems *Dr. Olga S. Pogorelova, Kyiv National University of Construction and Architecture, Ukraine*
15:10-15:30	AIC1049	Optimal control of problems with missing data and applications *Dr. Sihem Mahoui, University of Science and Technology Houari Boumediene, Algeria*
15:30-15:50	AIC1006	Fourth dimensional quantum data representation using turiyam set *Dr. Prem Kumar Singh, Gandhi Institute of Technology and Management-Visakhapatnam, India*
15:50-16:10	AIC1039	Parameter estimation and strong consistency for p-Order Random Coefficient Autoregressive (RCA) process based on kalman filter *Prof. Benmoumen Mohammed, Mohammed the First University, Morocco*
16:10-16:20	**BREAK**	
16:20-16:40	AIC1053	Truncated prakaamy distribution: properties and applications *Dr. Kamlesh Kumar Shukla, Noida International University, India*
16:40-16:55	AIC1031	Nonparametric relative error estimation through functional regressor under truncation random data with the k nearest neighbors method *Dr. Nadjet Bellatrach, Sidi Bel Abbès university, Algeria*
16:55-17:10	AIC1017	Methods for improving the performance of an automated system for calculating the instability of the zero level of electronic circuits with variations in parameters and external influences *Dr. Vladimir Gridin, Design Information Technologies Center Russian Academy of Sciences, Russia*
17:10-17:30	AIC1050	Weighted lindley multiplicative regression frailty models under random censored data *Dr. Shikhar Tyagi, Central University of Rajasthan, India*
17:30-17:45	AIC1044 (Video)	Critical sobolev problem with p-laplacian operator and with weight *Dr. Asma Benhamida, University of Tunis El Manar, Tunisia*

17:45-18:05	AIC1069	Multistep schemes for one and two dimensional electromagnetic wave models based on fractional derivative approximation *Dr. Rahul Kumar Maurya, Govt. Tilak PG College, India*
18:05-18:20	AIC1085	Trading cryptocurrencies using algorithmic average true range systems *Prof. Gil Cohen, Western Galilee Academic College, Israel*

Abstracts of Oral Session 4

AIC1027 On the classification of regular polyhedral complexes

Fumiko Ohtsuka*
Department of Mathematics, Faculty of Science, Ibaraki University, Japan
**Corresponding author: fumiko.ohtsuka.math@vc.ibaraki.ac.jp*

Abstract. Our research object is a polyhedral complex which is an object obtained by gluing isometric edges of convex polygons. It is said to be regular if all its faces are congruent to the same regular polygon and the neighborhoods of all vertices are isometric to each other. The concept of curvature can be introduced via its vertex structure. Surfaces of Platonic solids are natural examples of positive regular polyhedral complexes. However, 2-skeketons of higher dimensional regular polytopes are regular polyhedral complexes, but do not necessarily have positively curvature. In this talk, I would like to give an explicit definitions concerning our resarch object, and introduce some basic properties and some examples. Then, I would like to show the classification theorem for positive regular polyhedral complex. I was studying geodesic theory on Riemannian manifolds. As a space that appears in the collapse phenomena of manifolds, I wanted to investigate the nature of polyhedral complexes. I didn't get the interesting results I desired, so I tried to classify the space that could be considered as the model spaces. When approximating a phenomenon in a space of three or more dimensions, I feel that the application will expand if it is approximated by a polyhedral complex rather than a graph. I hope someone is interested in polyhedral complexes through this lecture and finds some unexpected use that I haven't imagined. My research field is geometry in pure mathematics. So, I am not familiar with conferences except geometry. This is a first time I have attained the conference of applied mathematics.

Keywords: polyhedral complexes, surfaces of platonic solids, 2-skeletons of regular polytopes

AIC1053 Truncated Prakaamy distribution: properties and applications

Kamlesh Kumar Shukla*
Department of Community Medicine, Noida International Institute of Medical Sciences, Noida International University, Gautam Budh Nagar, India.
**Corresponding author: kkshukla22@gmail.com*

Abstract. A truncated version of Prakaamy distribution has been introduced. The behaviors of its probability density function and survival function have been studied. The first two raw moments and the variance of the distribution have been given. Estimation of parameter has been discussed with maximum likelihood method. The Simulation study of proposed distribution has been presented. Goodness of fit of the proposed distribution has been explained with two real datasets.
Keywords: truncated distribution, maximum likelihood estimation, goodness of fit

AIC1018 Robustness of orthogonal uniform composite designs against missing data

Yankam Mbouamba Brenda*
Department of Statistics, University of Nigeria, Nsukka, Nigeria
**Corresponding author: brenda.yankam.pg03685@unn.edu.ng*

Abstract. There are various circumstances in an experiment whereby missing data arise as a result of the lost of some experimental units. Missing value in an experiment can affect the results of a response surface model and also impact negatively desirable properties of designs such as orthogonality, rotatability, and optimality. This paper construct new second-order response surface designs called orthogonal uniform minimax loss (OUCM) designs that are robust to a missing value. The OUCM designs are compared with existing orthogonal uniform composite designs (OUCDs) of Zhang et al. (2020) based on the relative D- and A-efficiencies for estimating the parameters of the second-order model. The OUCM designs are shown to be better in term of their losses. They also performed better in terms of the D- and A-efficiencies in estimating the second-order model than the OUCDs.
Keywords: second-order response surface designs, minimax loss criterion, missing data, d-efficiency, a-efficiency

AIC1054 Merits of Bayesian networks in overcoming the curse of dimensionality

Hasna Njah*
University of Sfax, Tunisia
**Corresponding author:* njah.hasna@gmail.com

Abstract. The abundant availability of data in Big Data era has helped achieving significant advances in the machine learning field. However, many high-dimensional datasets appear with incompleteness from different perspectives such as values, labels, annotations and records. Consequently, many machine learning methods struggle in providing reliable predictive and descriptive models. The implemented algorithms often struggle with learning a generalized model. The curse of dimensionality concept encompasses these challenges. Bayesian networks offer a promising remedy to these challenges as they rely on a strong graphical and probabilistic foundation. Their learning algorithms are robust against the noisy and incomplete data. Their underlying models are therefore capable of ensuring generalization even when learnt from high-dimensional datasets having small volumes. In this talk, these challenges will be discussed and the Bayesian network foundations will be explained. Additionally, the emphasis is put on the merits of Bayesian networks in overcoming the curse of dimensionality.

AIC1045 Numerical studies of intermittency and crisis-induced intermittency in vibro-impact systems

Petro P. Lizunov, Olga S. Pogorelova, and Tetiana G. Postnikova*
Kyiv National University of Construction and Architecture, Ukraine
**Corresponding author: posttan@ukr.net*

Abstract. Intermittency and crisis-induced intermittency are undesirable events in the dynamics of a nonlinear system. These are critical states of the system. These phenomena are accompanied by interior crises, a frequent alternation of motion modes from periodic to chaotic of different magnitudes with jumps in oscillatory amplitudes. After them, permanent sustained chaos may arise. They may be observed when any control parameter is changed. We watched them in two 2-DOF two-body vibro-impact systems – one with a rigid impact, another with a soft one. Numerical methods of applied and computational mathematics, modern software make it possible to accurately recognize these

phenomena and visualize them. Octave software provides integration of stiff differential equations set, which describes the vibro-impact movement of strongly nonlinear non-smooth discontinuous system. The Poincaré maps and their fractal structures show with all evidence the chaotic zones. The surfaces of wavelet coefficients and the projections of wavelet surfaces, obtained using Continuous Wavelet Transform, give clear visual pictures in the frequency-time space, which qualitatively characterize the motion. They look especially bright for crisis-induced intermittency and help to see a frequent alternation of various chaotic movements. The implementation of the Benettin algorithm for calculating the Lyapunov exponents makes it possible to find the largest Lyapunov exponent, which can be considered as one of the chaos criteria. Numerical studies make it possible to recognize the transient chaos; to show dependence of its lifetime and average lifetime both on control parameter value and on initial conditions; to calculate the escape rate and to obtain the exponential dependence of average lifetime on control parameter value. All these numerical investigations allow us to study the dynamic behavior of a strongly nonlinear non-smooth discontinuous vibro-impact system, find bifurcation points, determine the system critical states, and predict them. The forecasting of unwanted and dangerous states can help avoid such states both in design and in operation.
Keywords: numerical, nonlinear, discontinuous, vibro-impact, wavelet, crisis-induced intermittency

AIC1049 Optimal control of problems with missing data and applications

Sihem Mahoui*
University of Science and Technology Houari Boumediene, Faculty of Mathematics, Department of Analysis, AMNEDP laboratory, Algiers, Algeria
**Corresponding author: mahoui.sihem@gmail.com*

Abstract. Real life problems in general contains missing data, like for example in pollution, economy, agronomy or also pandemics, etc… To get the optimal control for this kind of problems, modelled by PDE's, we use the notion of no-regret control introduced by J.-L. Lions where we characterise it by a singular optimality system.
Keywords: partial differential equations, optimal control, no-regret control, low-regret control, optimality system

AIC1006 Fourth dimensional quantum data representation using turiyam set

Prem Kumar Singh*
Department of Computer Science and Engineering, Gandhi Institute of Technology and Management-Visakhapatnam, India
***Corresponding author: premsingh.csjm@gmail.com , premsingh.csjm@yahoo.com*

Abstract. Recently "Turiyam set" is introduced at Int'l Conference on Operations Research and Applications (ORA 2021) which held at Guilin, China. In this talk the author focused on dealing the uncertainty in data in data and its representation beyond the Acceptation, rejection and indeterminant parts. One of the examples is USA-China conflict is beyond the win, draw or loss of any event. It is totally based on consicious of USa(or China) to get profit (or loss) each other and vice versa. This fourth dimensional awareness is Turiyam. In similar way Indian-Pakistan match is beyond the Win, Draw or Loss of a match. It is totally focused on removal of Pakistan or India from the given series. Hence India (or Pakistan) may lose some match from lower team also just to remove India (or Pakistan). This type of matches results already known as fourth dimensions of human cognition. It is based on non-dualism concept of Sanskrit or Taoism Yin-Yang theory of China. Another suitable example is COVID data set representation contains fourth dimensions uncertainty for the analysis. The people who got recovered can be considered as true regions (*t*), people who died due to COVID19 can be

considered as false regions (*f*), people who are still active can be considered as indeterminacy (*i*), people who got vaccinated can be considered as Turiya or Liberated state (*l*). The refusal degree means people who still did not come under these regions can be represented as 1-(*t*+*i*+*f*+*l*). However the exploration of Turiyam dimensions is not easy. It is much complex than Space Time Tradeoffs as we deal some time unknown data. Recently, Turiyam modules, Turiyam matrix and its vector is introduced for dealing the quantum data. This talk will focus on providing a brief about Turiyam dimension and its data representation for further discussions and development.

Keywords: cognitive science, fourth-way decision space, non-duality, non-euclidean, quantum information, unknown, turiyam set

AIC1039

Parameter estimation and strong consistency for p-order Random Coefficient Autoregressive (RCA) process based on kalman filter

Benmoumen Mohammed*

Department of Mathematics, Faculty of Sciences, Mohammed the First University, Morocco

**Corresponding author: med.benmoumen@gmail.com*

Abstract. In this paper we elaborate an algorithm to estimate p-order Random Coefficient Autoregressive process (RCA(p)) parameters. This algorithm combines quasi-maximum likelihood method, the Kalman filter, and the simulated annealing method. In the aim to generalize the results found for RCA(1) (see Benmoumen and al 2013), we have integrated a sub-algorithm which calculates the theoretical autocorrelation. We also investigate the strong consistency of the quasi-maximum likelihood estimators d,erived through the Kalman filter for stationary random coefficient autoregressive (RCA) process (Benmoumen and Salhi 2021).

Simulation results demonstrate that the algorithm is viable and promising."

AIC1031 Nonparametric relative error estimation through functional regressor under truncation random data with the k nearest neighbors method

Nadjet Bellatrach[1], Bouabsa Wahiba[2]

[1] *Laboratory of Statistics stochastic processes,Sidi Bel Abbès University , Algeria*

[2] *Laboratory of Statistics stochastic processes,Sidi Bel Abbès University , Algeria*

Corresponding author: *bellatrachnadjet@gmail.com, wahiba_bouab@yahoo.fr*

Abstract. It is well known that the nonparametric estimation of the regression function is highly sensitive to the presence of even a small proportion of things that aren't part of the main group in the data. To solve the problem of typical observations when the covariates of the nonparametric component are functional, the robust estimates for the regression parameter and regression operator are introduced. The main propose of the paper is to think about data-driven methods of selecting the number of neighbors in order to make the proposed processes fully automatic. We use the k Nearest Neighbors procedure (kNN) to construct the kernel estimator of the proposed strong and healthy model. The information currently available is study of Demongeot et al. (2016), that has made the research of this topic especially important when the regressors are of functional character. The difficulty in our study is the bandwidth factor is a random variable in the kNN system, using the same strategies of Burba et al. (2009). The main goal of this study is to build the regression function for the non-

parametric estimator by relinking the Relative Error approach with those of truncated data using the kNN method through functional regressor.

Keywords: functional data analysis, truncation model, knn method, relative error, functional nonparametric statistics, almost complete convergence rate

AIC1017 Methods for improving the performance of an automated system for calculating the instability of the zero level of electronic circuits with variations in parameters and external influences

V.N. Gridin[1], V.I. Anisimov[12], S.A.Vasiliev[12]
[1] *Design Information Technologies Center Russian Academy of Sciences, Russia*
[2] *St. Petersburg Electrotechnical University, St. Petersburg, Russia*
Corresponding author: *info2@ditc.ras.ru, vianisimov@inbox.ru*

Abstract. The report discusses the construction of a mathematical description of the calculation of the instability of the zero level of electronic circuits for the common case when the coordinates of the working points of all circuit components are known, and it is required to find their deviations when the parameters of the circuit components vary under the influence of external influences (temperature, humidity, pressure, radiation, etc.), as well as the technological spread of the component parameters during their manufacture. The advantage of the proposed technique is the possibility to eliminate the need for repeated calculation of a nonlinear circuit and its sensitivity to parameter variation and proceed to the consideration of a mathematical description of a linearized circuit for deviations of variables from the initial stationary value. At the same time, the volume of computational operations is sharply reduced and the solution time is reduced, which is especially important when solving optimization problems of designing electronic circuits.

AIC1050 Weighted lindley multiplicative regression frailty models under random censored data

Shikhar Tyagi[1], Arvind Pandey[1], Varun Agiwal[2], and Christophe Chesneau[3]

[1] *Department of Statistics, Central University of Rajasthan, Ajmer, Rajasthan, India*
[2] *Department of Community Medicine, Jawaharlal Nehru Medical College, Ajmer, Rajasthan, India*
[3] *Université de Caen Normandie, LMNO, Campus II, Science 3, 14032 Caen, France*
Corresponding author: christophe.chesneau@gmail.com

Abstract. The emphasis of conventional survival research methods has historically been on the occurrence of failures over time. The lack of knowledge of related observed and unobserved covariates during the study of such events can have negative consequences. Frailty models are a viable option for investigating the impact of unobserved covariates in this context. In this article, we suppose that frailty multiplies the hazard rate. As a useful method to ensure the effect of unobserved heterogeneity, we propose weighted Lindley (WL) frailty models with generalized Weibull (GW) and generalized log-logistic-II (GLL2) as the baseline distributions. The Bayesian paradigm of Markov Chain Monte Carlo (MCMC) methodology is used to estimate the model parameters. Subsequently, model comparisons are performed via Bayesian comparison techniques. The popular kidney data set is considered to illustrate the results. It is shown that the new models perform better than those based on gamma and inverse Gaussian frailty distributions.

Keywords: Bayesian estimation, frailty, generalized log-logistic distribution, generalized weibull distribution, hazard rate, mcmc, random censoring, weighted lindley frailty

AIC1044 Critical Sobolev Problem with p-Laplacian operator and with weight

Asma Benhamida[1], Habib Yazidi[2*]
[1] *Department of Mathematics, Faculty of Mathematical, Physical and Natural Sciences of Tunis, Campus Universitaire, 2092 Tunisia, University of Tunis El Manar, Tunisia*
[2] *University of Tunis, National Engineering School of Tunis, 5 Avenue Taha Hssine, Bab Mnar 1008 Tunis, Tunisia*
[*] *Corresponding author: habib.yazidi@gmail.com*

Abstract. We consider the problem $-\div(\alpha(x)|\nabla u|^{p-2}\nabla u)=\lambda |u|^{q-2}u+|u|^{p^{\star}-2}u, u> 0 $ in Ω, $u=0$ on $\partial\Omega, $ where Ω is a bounded domain in $\R^{N}$, $N>p$, α a positive continuous potential on $\bar{\Omega}$, p^{*} the critical Sobolev exponent and $2\leq p\leq q< p^{*}$ and λ is a real constant. We prove the existence of some positive solutions which depends, among others, on the behavior of the potential $\alpha(.)$ near its minima, the position of p^{2} with respect to the dimension of the space and on the position of q with respect to some precise values.
Keywords: critical sobolev exponent, p-laplacian operator, best sobolev constant
Acknowledgements: Asma Benhamida acknowledges the Tunisian Ministry of Higher Eduction and Scientific Research as well as the University of Tunis El Manar

AIC1069 Multistep schemes for one and two dimensional electromagnetic wave models based on fractional derivative approximation

Rahul Kumar Maurya[*]
Govt. Tilak PG College, Katni, MP, India
[*] *Corresponding author: iitrahulbhu@gmail.com*

Abstract. In this work, multistep finite difference schemes are developed for solving one-dimensional (1D) and two-dimensional (2D) fractional differential models of electromagnetic waves (FDMEWs) arising from dielectric media which contain both initial and Dirichlet boundary conditions. The Caputo's fractional derivatives in time are discretized by a difference scheme of order O(tau(3-alpha)) & O(tau(3-beta)), 1 < beta < alpha < 2, and the Laplacian operator is approximated by central difference discretization. The proposed multistep schemes transform the FDMEWs into the tridiagonal system for the 1D cases and a pentagonal system for 2D cases. Theoretical unconditional stability, convergence analysis and error bounds are investigated. For 1D FDMEWs, accuracy of order O(tau(3-alpha)+ tau(3-beta)+ h(2)) and for 2D FDMEWs, accuracy of order O(tau(3-alpha)+ tau(3-beta)+ h(1)(2) + h(2)(2)) are investigated, where 1 < beta < alpha < 2. Several test examples are included to verify the reliability and computational efficiency of the proposed schemes which support our theoretical findings for both 1D and 2D cases.
Keywords: finite difference method, stability analysis, convergence analysis, fractional diffusion wave equation

AIC1085 Trading cryptocurrencies using algorithmic average true range systems

Gil Cohen*

School of Management of Western Galilee Academic College, Acre, Israel
**Corresponding author:* gilc@wgalil.ac.il

Abstract. This research makes the first attempt to design, optimize and use Average True Range (ATR) based trading systems for five popular cryptocurrencies. We used particle swarm optimization procedures to optimize systems with multiple objectives that are based on the ATR concept. Our aim was to determine the best configurations for each system that would maximize net profits, the profit factor, and the percentage of profitable trades. We demonstrate that the ATR based systems can predict the price trends of the examined cryptocurrencies. Our results also indicate that optimized Keltner Channel based systems improve the ability of the stand-alone optimized ATR systems to forecast trends, net profits, and the profit factor. Finally, both systems perform better for long trades than for short trades.
Keywords: cryptocurrencies, intraday trading, algorithmic, artificial intelligence

Part V Acknowledgements

On behalf of the AMICS Organizing Committee, we would like to take this opportunity to express our sincere gratitude to our participants. Without their support and contributions, we would not be able to hold the conference successfully in this special year. We would also like to express our acknowledgements to the Technical Program Committee members who have given their professional guidance and valuable advice as reviewers. Below are the lists of the Technical Program Committee members. For those who contribute to the success of the conference organization without listing the name here, we would love to say thanks as well.

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